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**Bondurant et al.**

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(54) **OPTICAL THREAD PROFILER**

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This patent is subject to a terminal disclaimer.

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**G01B 11/24** (2006.01)

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CPC ..... **G01B 11/2425** (2013.01); **G01B 11/24** (2013.01)

(58) **Field of Classification Search**

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See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

3,924,953	A	12/1975	Allard
4,315,688	A	2/1982	Pryor
4,644,394	A	2/1987	Reeves
5,521,707	A	5/1996	Castore
5,571,222	A	11/1996	Ludwig
7,490,411	B2	2/2009	Matsumiya

(Continued)

**OTHER PUBLICATIONS**

International Search Report and Written Opinion mailed Aug. 6, 2012, in International Patent Application No. PCT/US2012/041932, filed Jun. 11, 2012, 8 pages.

(Continued)

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(57) **ABSTRACT**

An apparatus configured to measure at least one physical characteristic of a threaded surface (e.g., an internally threaded surface) of an object is provided. The apparatus uses optical triangulation to perform non-contact characterization of the threaded surface. The apparatus can be used to characterize various aspects of the threaded surface, including generating the measurements required to produce a longitudinal cross-sectional profile of the threaded surface.

**25 Claims, 16 Drawing Sheets**

